

Network Working Group  
Request for Comments: 3901  
BCP: 91  
Category: Best Current Practice

A. Durand  
SUN Microsystems, Inc.  
J. Ihren  
Autonomica  
September 2004

## DNS IPv6 Transport Operational Guidelines

### Status of this Memo

This document specifies an Internet Best Current Practices for the Internet Community, and requests discussion and suggestions for improvements. Distribution of this memo is unlimited.

### Copyright Notice

Copyright (C) The Internet Society (2004).

### Abstract

This memo provides guidelines and Best Current Practice for operating DNS in a world where queries and responses are carried in a mixed environment of IPv4 and IPv6 networks.

1. Introduction to the Problem of Name Space Fragmentation:  
following the referral chain

A resolver that tries to look up a name starts out at the root, and follows referrals until it is referred to a name server that is authoritative for the name. If somewhere down the chain of referrals it is referred to a name server that is only accessible over a transport which the resolver cannot use, the resolver is unable to finish the task.

When the Internet moves from IPv4 to a mixture of IPv4 and IPv6 it is only a matter of time until this starts to happen. The complete DNS hierarchy then starts to fragment into a graph where authoritative name servers for certain nodes are only accessible over a certain transport. The concern is that a resolver using only a particular version of IP and querying information about another node using the same version of IP can not do it because somewhere in the chain of servers accessed during the resolution process, one or more of them will only be accessible with the other version of IP.

With all DNS data only available over IPv4 transport everything is simple. IPv4 resolvers can use the intended mechanism of following referrals from the root and down while IPv6 resolvers have to work

through a "translator", i.e., they have to use a recursive name server on a so-called "dual stack" host as a "forwarder" since they cannot access the DNS data directly.

With all DNS data only available over IPv6 transport everything would be equally simple, with the exception of IPv4 recursive name servers having to switch to a forwarding configuration.

However, the second situation will not arise in the foreseeable future. Instead, the transition will be from IPv4 only to a mixture of IPv4 and IPv6, with three categories of DNS data depending on whether the information is available only over IPv4 transport, only over IPv6 or both.

Having DNS data available on both transports is the best situation. The major question is how to ensure that it becomes the norm as quickly as possible. However, while it is obvious that some DNS data will only be available over v4 transport for a long time it is also obvious that it is important to avoid fragmenting the name space available to IPv4 only hosts. For example, during transition it is not acceptable to break the name space that we presently have available for IPv4-only hosts.

## 2. Terminology

The phrase "IPv4 name server" indicates a name server available over IPv4 transport. It does not imply anything about what DNS [1,2] data is served. Likewise, "IPv6 [4,5,6] name server" indicates a name server available over IPv6 transport. The phrase "dual-stack name server" indicates a name server that is actually configured to run both protocols, IPv4 and IPv6, and not merely a server running on a system capable of running both but actually configured to run only one.

## 3. Policy Based Avoidance of Name Space Fragmentation

Today there are only a few DNS "zones" on the public Internet that are available over IPv6 transport, and most of them can be regarded as "experimental". However, as soon as the root and top level domains are available over IPv6 transport, it is reasonable to expect that it will become more common to have zones served by IPv6 servers.

Having those zones served only by IPv6-only name server would not be a good development, since this will fragment the previously unfragmented IPv4 name space and there are strong reasons to find a mechanism to avoid it.

The recommended approach to maintain name space continuity is to use administrative policies, as described in the next section.

#### 4. DNS IPv6 Transport recommended Guidelines

In order to preserve name space continuity, the following administrative policies are recommended:

- every recursive name server SHOULD be either IPv4-only or dual stack,

This rules out IPv6-only recursive servers. However, one might design configurations where a chain of IPv6-only name server forward queries to a set of dual stack recursive name server actually performing those recursive queries.

- every DNS zone SHOULD be served by at least one IPv4-reachable authoritative name server.

This rules out DNS zones served only by IPv6-only authoritative name servers.

Note: zone validation processes SHOULD ensure that there is at least one IPv4 address record available for the name servers of any child delegations within the zone.

#### 5. Security Considerations

The guidelines described in this memo introduce no new security considerations into the DNS protocol or associated operational scenarios.

#### 6. Acknowledgment

This document is the result of many conversations that happened in the DNS community at IETF and elsewhere since 2001. During that period of time, a number of Internet drafts have been published to clarify various aspects of the issues at stake. This document focuses on the conclusion of those discussions.

The authors would like to acknowledge the role of Pekka Savola in his thorough review of the document.

## 7. Normative References

- [1] Mockapetris, P., "Domain names - concepts and facilities", STD 13, RFC 1034, November 1987.
- [2] Mockapetris, P., "Domain names - implementation and specification", STD 13, RFC 1035, November 1987.
- [3] Bradner, S., "The Internet Standards Process -- Revision 3", BCP 9, RFC 2026, October 1996.
- [4] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", RFC 2460, December 1998.
- [5] Hinden, R. and S. Deering, "Internet Protocol Version 6 (IPv6) Addressing Architecture", RFC 3513, April 2003.
- [6] Thomson, S., Huitema, C., Ksinant, V., and M. Souissi, "DNS Extensions to Support IP Version 6", RFC 3596, October 2003.

## 8. Authors' Addresses

Alain Durand  
SUN Microsystems, Inc  
17 Network circle UMPK17-202  
Menlo Park, CA, 94025  
USA

EMail: Alain.Durand@sun.com

Johan Ihren  
Autonomica  
Bellmansgatan 30  
SE-118 47 Stockholm  
Sweden

EMail: johani@autonomica.se

## 9. Full Copyright Statement

Copyright (C) The Internet Society (2004).

This document is subject to the rights, licenses and restrictions contained in BCP 78, and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/S HE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

## Intellectual Property

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the IETF's procedures with respect to rights in IETF Documents can be found in BCP 78 and BCP 79.

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at [ietf-ipr@ietf.org](mailto:ietf-ipr@ietf.org).

## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

